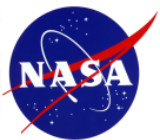


GOLD

Space Weather Observations from the GOLD Mission

Richard Eastes and the GOLD Team

(W. E. McClintock, A. G. Burns, S. C. Solomon, D. N. Anderson, L. Andersson, M. Codrescu, R. E. Daniell, S. L. England, J. E. Harvey, A. Krywonos, M. Lankton, J. D. Lumpe, A. D. Richmond, D. W. Rusch, O. Siegmund, D. J. Strickland, T. N. Woods, A. Aksnes, S. A. Budzien, K. F. Dymond, F. G. Eparvier, H. Foroosh, R. S. Lieberman, C. R. Martinis, and J. Oberheide)

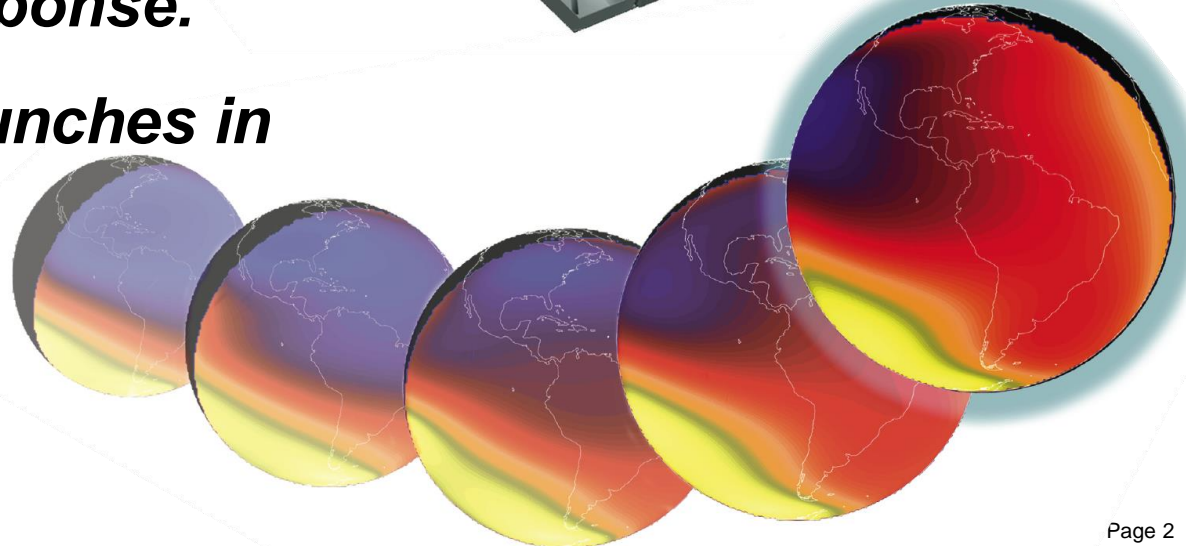
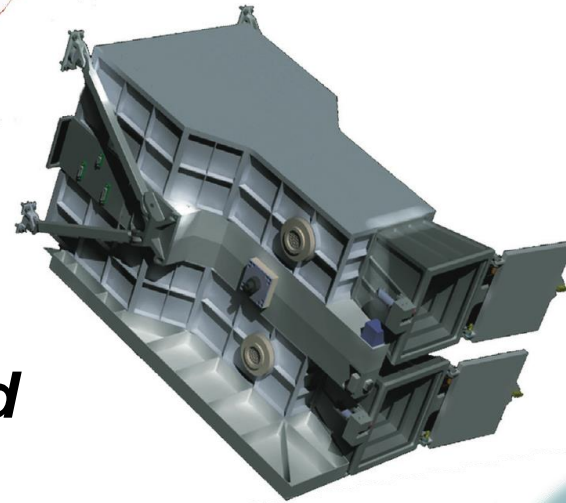
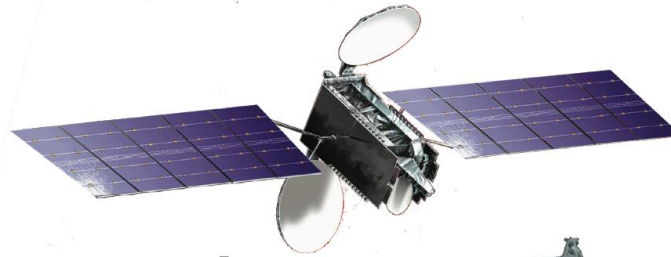


Imaging the Boundary Between Earth and Space **GOLD**

GOLD Mission of Opportunity will study how space around Earth responds to the Sun and the lower atmosphere.

GOLD will make unprecedented images of Earth's response.

GOLD FUV imager launches in 2017.



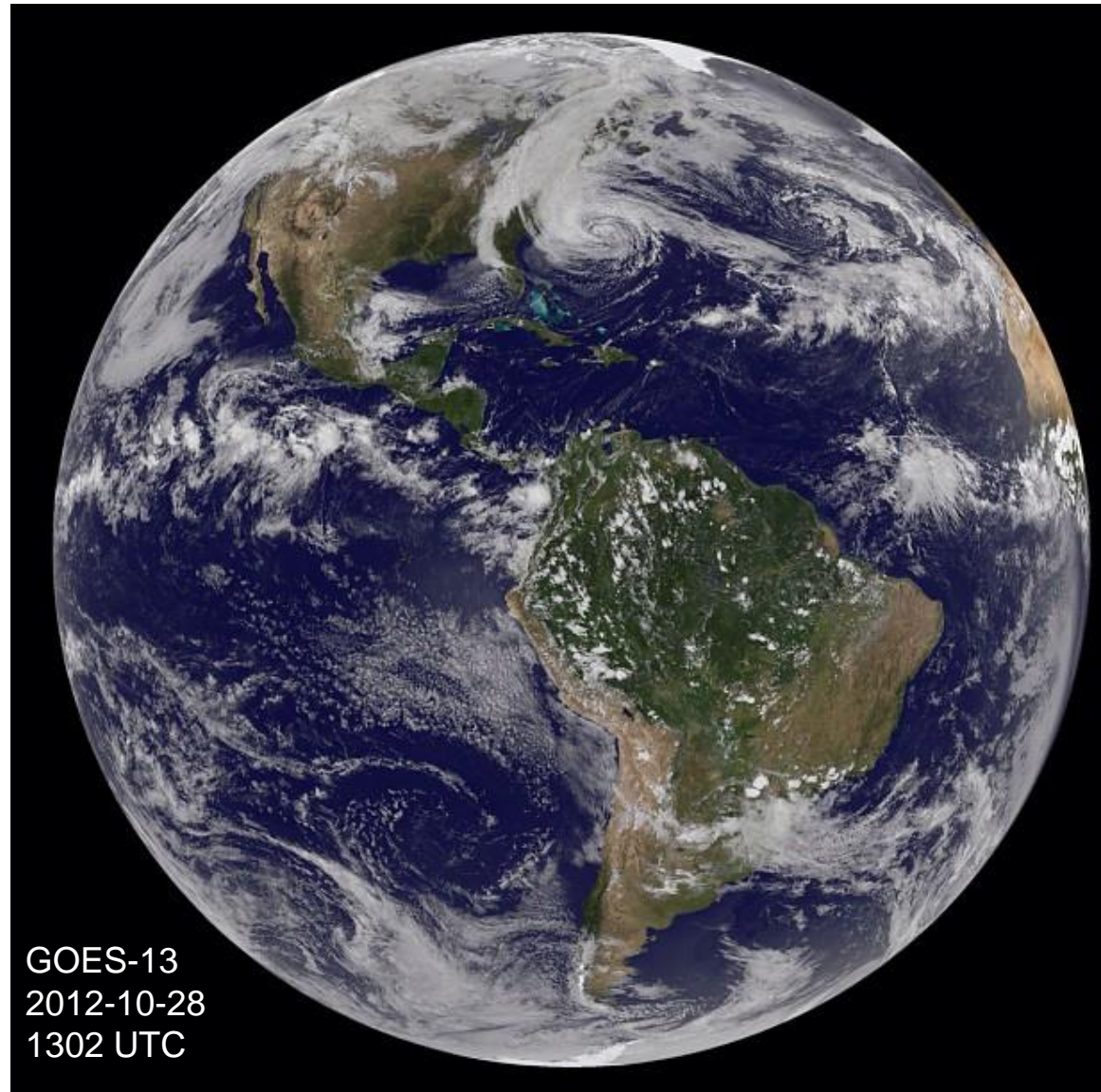
The View from Geostationary Orbit

GOLD

**GOLD images the
disk and limb from
geostationary orbit**

**Full images at
30-minute cadence**

**GOLD measures the
composition and
temperature of the
thermosphere**



GOES-13
2012-10-28
1302 UTC

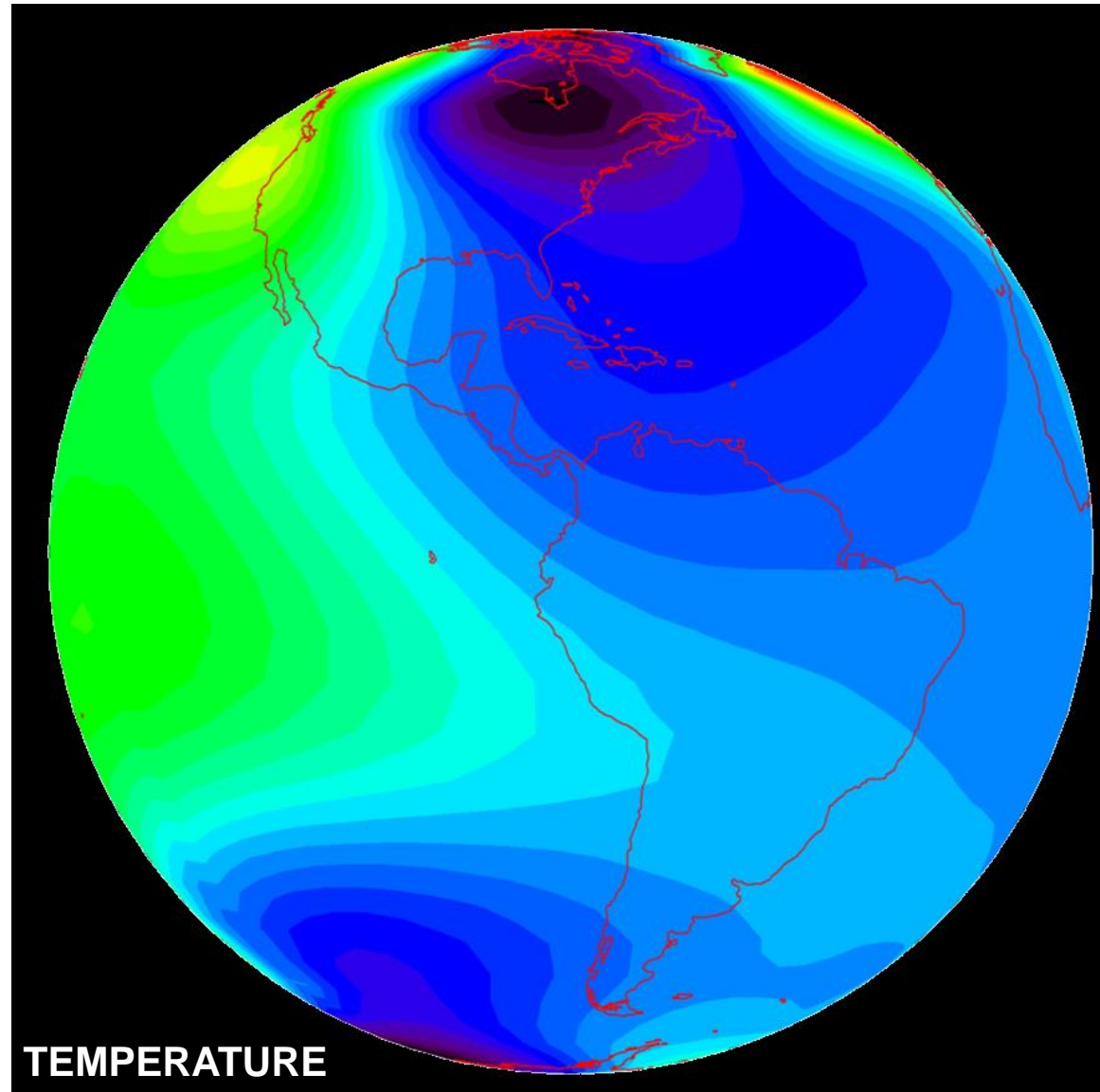
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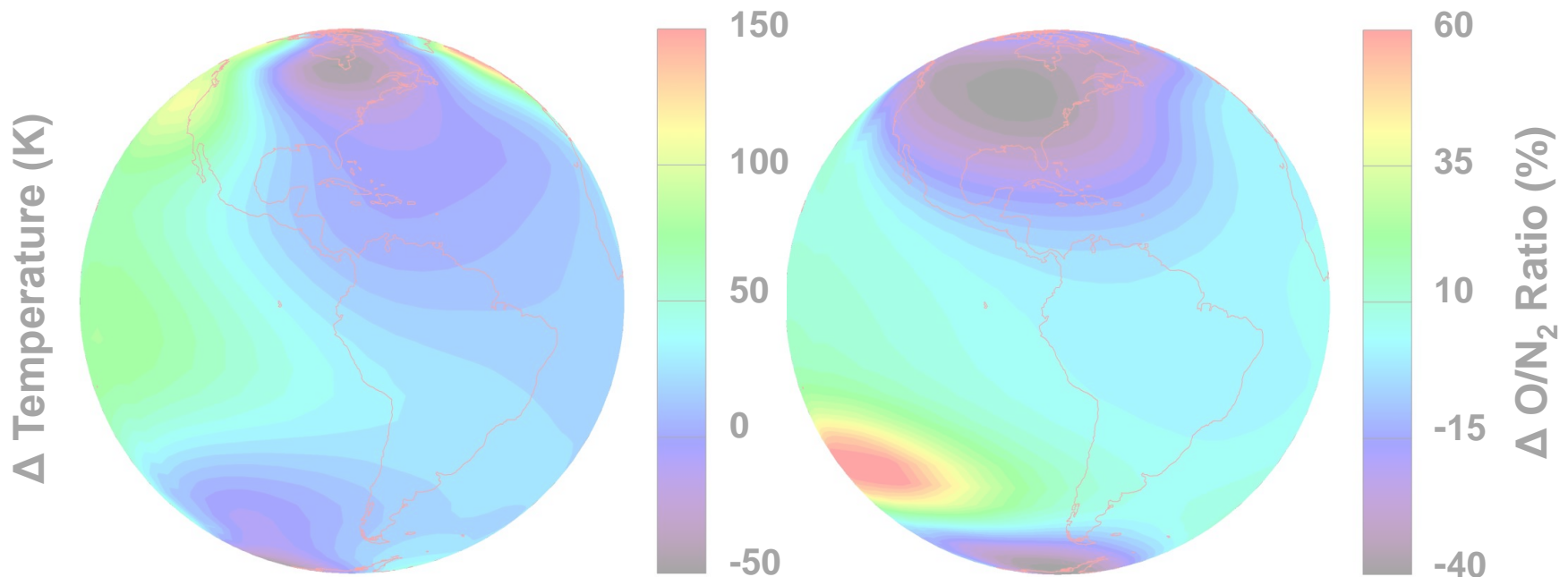


GOLD's Most Important Result



GOLD will discover how the upper atmosphere acts as a weather system

How do geomagnetic storms impact Earth's space environment?



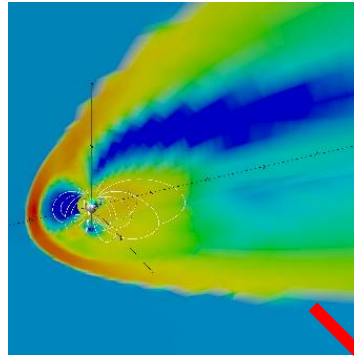
Modeled changes in upper atmosphere during storm

Weather in the Thermosphere-Ionosphere

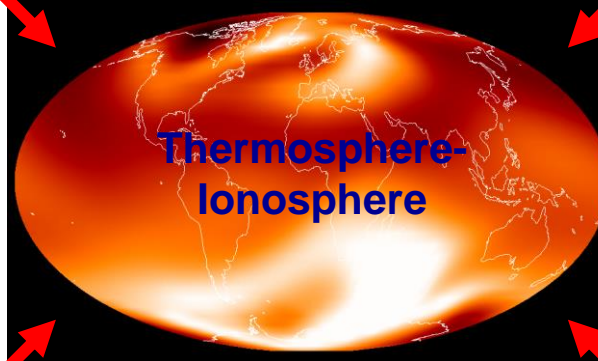
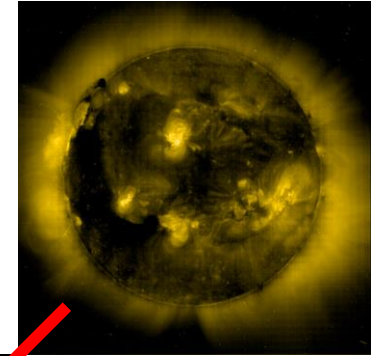
GOLD

Solar Wind and Magnetosphere

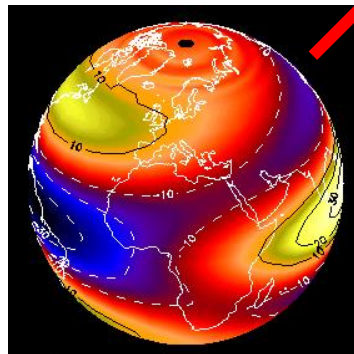
Solar Ultraviolet and X-rays



*Forcing
from
Above*



*Forcing
from
Below*



Tides and Planetary Waves

Turbulence and Convection

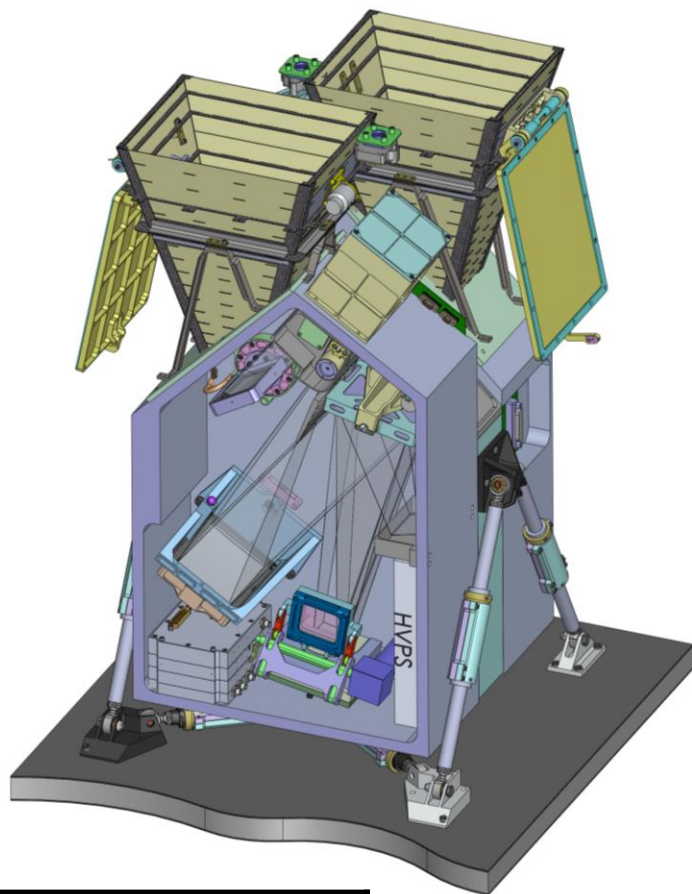
CHALLENGE:
The thermosphere-ionosphere system changes rapidly in response to forcing

APPROACH:
Ultraviolet imaging from geostationary orbit

RESULT: Resolve interactions between drivers of the coupled system

GOLD UV Imaging Spectrograph

GOLD



Instrument Summary	
Mass	30 kg
Power	24 W
Size	42 × 42 × 70 cm

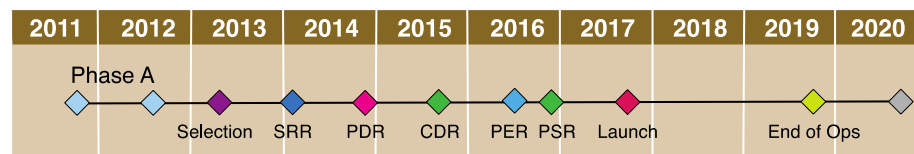
Imaging Spectrograph:

- Two independent, identical channels
- Microchannel plate, 2-D detectors
- Individual photon events recorded
- Spectral resolution: 0.3, 1.0 and 7 nm

Heritage:

- Cassini UVIS
- MESSENGER MASCS
- MAVEN IUVS (launched Nov., 2013)

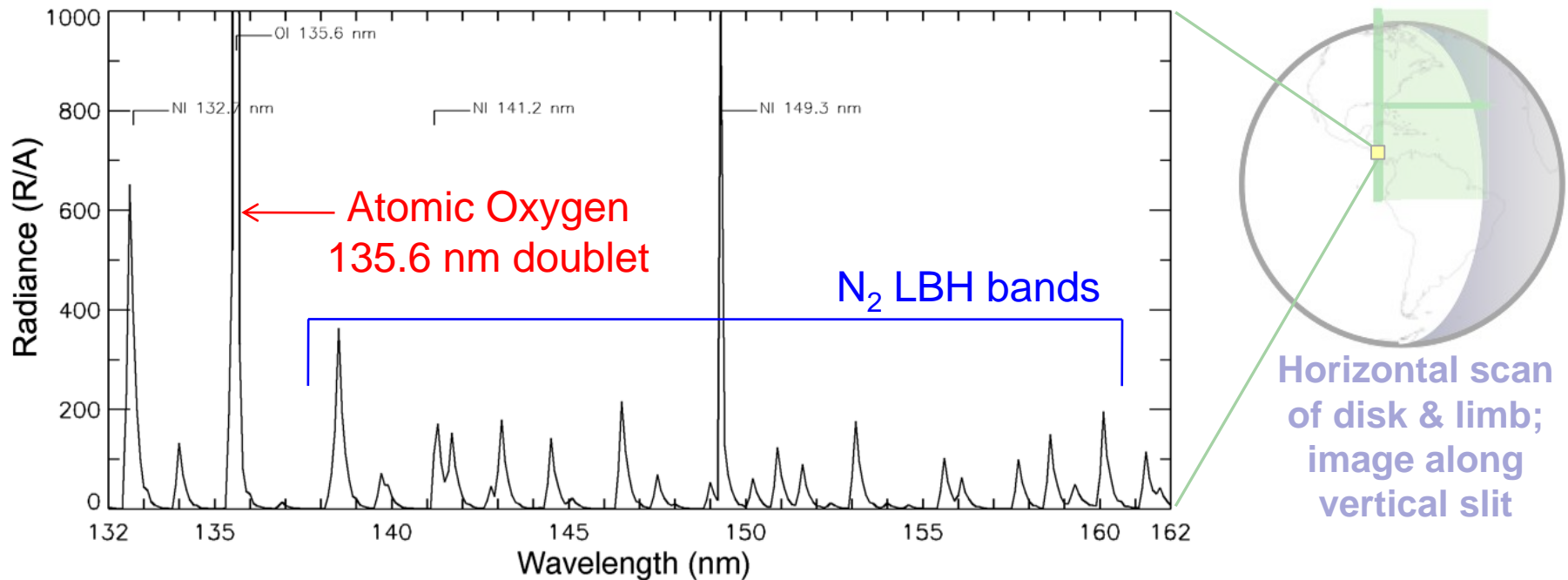
Schedule:



Observations:

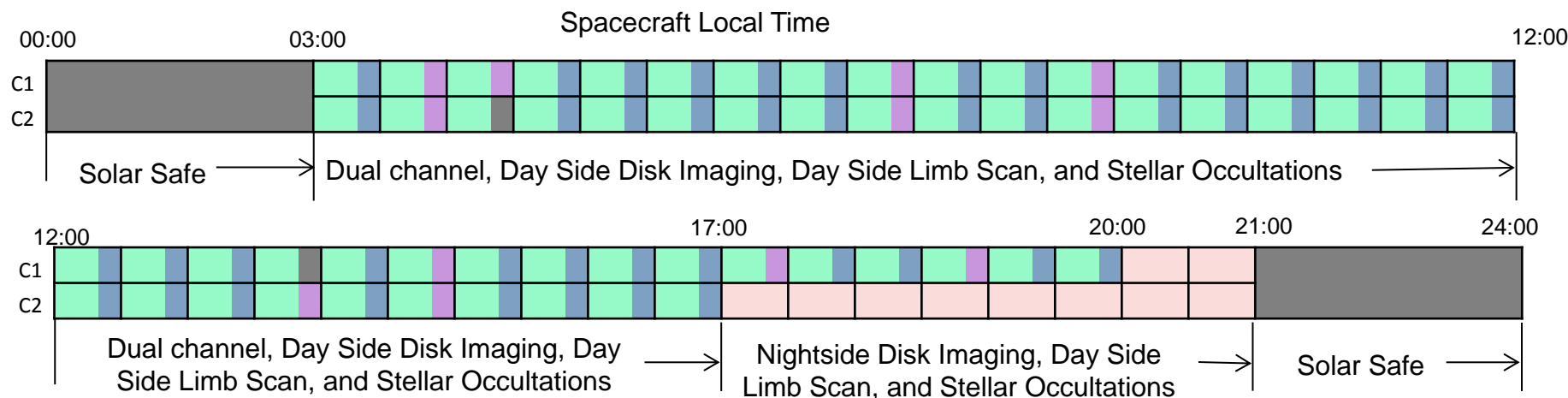
- Disk maps of T_{neutral} and O/N₂ density ratio (dayside)
- T_{exo} from dayside limb scans
- Disk maps of N_e maximum (nightside)
- O₂ density by occultations

Daytime Far-Ultraviolet Spectrum



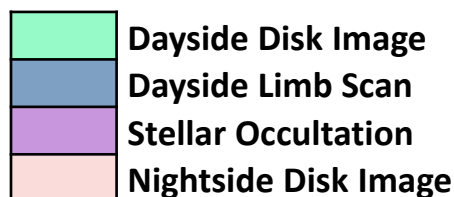
- Temperature (T_{neutral}) on disk measured using shape of N₂ LBH bands
- O/N₂ density ratio on disk measured using ratio of 135.6 doublet to LBH bands
- Exospheric temperature (T_{exo}) from N₂ limb emission altitude profile
- N_e maximum at night from 135.6 recombination emission
- O₂ profile on limb from stellar occultations

Concept for Observing Operations



• Nominal GOLD observing modes:

Legend



- Full disk maps and limb scans with 30 minute cadence
 - HR (0.3 nm): Dayside (disk temperature, disk O/N₂, and T_{exo})
 - Disk data products include neutral T and O/N₂ ratio at 250 km x 250 km spatial resolution for storms
 - LR (1 nm): Nightside (disk O emissions to map N_e max and bubbles)
- O₂ occultation measurements
 - OCC: Dayside and Nightside
 - Interrupt nominal disk scans (5% duty cycle)

- **GOLD addresses major goals of 2012 Heliophysics Decadal Survey:**
 - “Determine the dynamics and coupling of Earth’s magnetosphere, ionosphere, and atmosphere and their response to solar and terrestrial inputs.”*
 - “Develop a strategic capability to make global-scale atmosphere-ionosphere-magnetosphere imaging measurements from host spacecraft, notably those in...geostationary orbits.”*
- **Unprecedented disk imaging of temperature and composition**
- **Able to separate changes in time from changes in location**
- **Coincident with ground-based measurements at 30 minute cadence**
- **Provides context for ground-based and LEO measurements**
- **Near real-time data availability**

GOLD provides a new capability for Space Weather